PROCEEDINGS

OF THE

NATIONAL ACADEMY OF SCIENCES

OF THE

UNITED STATES OF AMERICA

VOLUME 39, 1953

EDITORIAL BOARD

LINUS PAULING, *Chairman* — EDWIN B. WILSON, *Managing Editor*

ALEXANDER WETMORE, *Home Secretary* — ROGER ADAMS, *Foreign Secretary*

WILLIAM W. RUBEY, *Chairman of the National Research Council*

J. W. BEAMS — G. W. BEADLE — GREGORY BREIT

R. E. CLELAND — E. A. DOISY — L. C. DUNN

W. W. RUBEY — G. C. EVANS — W. F. LIBBY

HARLOW SHAPLEY — C. H. GRAHAM — J. VON NEUMANN

F. E. TERMAN — J. T. PATTERSON — PAUL WEISS

PUBLISHED MONTHLY

Publication Office: Mack Printing Company, Easton, Pa.

Editorial Office and Home Office of the Academy

2101 Constitution Avenue, Washington 25, D. C.

CONTENTS

NATIONAL ACADEMY OF SCIENCES

		Page
ORGANIZATION—OFFICERS, COUNCIL, MEMBERS, FOREIGN ASSOCIATES, SECTIONS, COMMITTEES, TRUST FUNDS		695
VITAL STATISTICS OF OUR FOREIGN ASSOCIATES	*By Edwin B. Wilson*	1295

MATHEMATICS

ON COMPLEXES WITH OPERATORS	*By Beno Eckmann*	35
MINIMAX THEOREMS	*By Ky Fan*	42
ON THE POINCARÉ POLYNOMIALS OF THE CLASSICAL GROUPS—ADDENDUM	*By F. D. Murnaghan*	48
ON EIGENFUNCTION EXPANSIONS	*By F. I. Mautner*	49
REPRESENTATIONS BY CUBIC CONGRUENCES	*By Eckford Cohen*	119
ALMOST PERIODIC FUNCTIONS ON LOCALLY COMPACT GROUPS	*By Raimond A. Struble*	122
ASSUMPTION OF BOUNDARY VALUES AND THE GREEN'S FUNCTION IN THE DIRICHLET PROBLEM FOR THE GENERAL LINEAR ELLIPTIC EQUATION	*By Felix E. Browder*	179
LINEAR PARABOLIC DIFFERENTIAL EQUATIONS OF ARBITRARY ORDER; GENERAL BOUNDARY-VALUE PROBLEMS FOR ELLIPTIC EQUATIONS	*By Felix E. Browder*	185
STOCHASTIC PROCESSES WITH FINITE AND NON-FINITE VARIANCE	*By S. Bochner*	190
A PROPERTY OF MINIMAL SURFACES	*By Robert Finn*	197
SECOND ORDER ELLIPTIC SYSTEMS OF DIFFERENTIAL EQUATIONS	*By Charles B. Morrey, Jr.*	201
SPIRALS IN THE PLANE	*By R. L. Moore*	207
HOMOLOGY GROUPS OF SYMMETRIC GROUPS AND REDUCED POWER OPERATIONS	*By N. E. Steenrod*	213
CYCLIC REDUCED POWERS OF COHOMOLOGY CLASSES	*By N. E. Steenrod*	217
ON SOME VARIATIONAL PROBLEMS OCCURRING IN THE THEORY OF DYNAMIC PROGRAMMING	*By Richard Bellman, Irving Glicksberg, and Oliver Gross*	298
FOURIER TRANSFORMS OF TIME SERIES	*By S. Bochner*	302
ON THE BASIS THEOREM FOR FINITE ABELIAN GROUPS: IV	*By Jesse Douglas*	307
GAMES WITH EQUILIBRIUM POINTS	*By Richard Otter and John Dunne*	310
ON THE NUMBER OF HUSIMI TREES, I	*By Frank Harary and George E. Uhlenbeck*	315
STUDIES IN THE CONFORMAL MAPPING OF RIEMANN SURFACES, I	*By Maurice Heins*	322
THE PARAMETRISATION AND ELEMENT OF VOLUME OF THE UNITARY SYMPLECTIC GROUP	*By F. D. Murnaghan*	324
HEAT CONDUCTION ON ARBITRARY RIEMANNIAN MANIFOLDS	*By D. C. Spencer*	327
ABSOLUTE VALUED ALGEBRAS	*By Fred B. Wright*	330
ON THE EIGENFUNCTIONS AND EIGENVALUES OF THE GENERAL LINEAR ELLIPTIC DIFFERENTIAL OPERATOR	*By Felix E. Browder*	433
ON DIFFERENTIAL GEOMETRY IN THE LARGE	*By H. E. Rauch*	440
A THEORY OF *N* PERSON GAMES WITH PERFECT INFORMATION	*By David Gale*	496
THE SPINOR CONNECTION IN THE UNIFIED EINSTEIN THEORY OF RELATIVITY	*By Václav Hlavatý*	501

CONNECTIONS BETWEEN EINSTEIN'S TWO UNIFIED THEORIES OF RELATIVITY. By Václav Hlavatý 507
ON THE CONTRACTION OF GROUPS AND THEIR REPRESENTATIONS. By E. Inonu and E. P. Wigner 510
ERGODIC PROPERTY OF THE BROWNIAN MOTION PROCESS. By G. Kallianpur and H. Robbins 525
OMNIBUS CHECKING OF THE 61-PLACE TABLE OF DENARY LOGARITHMS COMPILED BY PETERS AND STEIN, BY CALLET, AND BY PARKHURST. By Horace S. Uhler 533
SIGNIFICANCE LEVELS FOR A SKEW DISTRIBUTION. By Edwin B. Wilson 537
RELATIONS ON ITERATED REDUCED POWERS. By José Adem 636
CONSTRAINED GAMES AND LINEAR PROGRAMMING. By A. Charnes 639
ON ARITHMETIC GENERA OF ALGEBRAIC VARIETIES. By K. Kodaira and D. C. Spencer 641
EXTENSION THEOREMS FOR SOLUTIONS OF IRREFLEXIVE RELATIONS. By Moses Richardson 649
A FIRST APPROXIMATION TO HOMOTOPY THEORY. By E. H. Spanier and J. H. C. Whitehead 655
COHOMOLOGY AND THE RIEMANN-ROCH THEOREM. By D. C. Spencer 660
APPROXIMATE METHODS IN MATHEMATICS. By M. Herzberger 853
ERGODIC THEORY OF MARKOV CHAINS ADMITTING AN INFINITE INVARIANT MEASURE. By T. E. Harris and Herbert Robbins 860
ON COHOMOLOGY GROUPS OF COMPACT ANALYTIC VARIETIES WITH COEFFICIENTS IN SOME ANALYTIC FAISCEAUX. By K. Kodaira 865
GROUPS OF COMPLEX LINE BUNDLES OVER COMPACT KÄHLER VARIETIES. By K. Kodaira and D. C. Spencer 868
DIVISOR CLASS GROUPS ON ALGEBRAIC VARIETIES. By K. Kodaira and D. C. Spencer 872
BOTTLENECK PROBLEMS AND DYNAMIC PROGRAMMING. By Richard Bellman 947
ON STEENROD'S REDUCED POWERS, THE INDEX OF INERTIA, AND THE TODD GENUS. By Friedrich Hirzebruch 951
THE IDEAS OF VARIABLE AND FUNCTION. By Karl Menger 956
PAIRS OF MATRICES WITH PROPERTY L. By T. S. Motzkin and Olga Taussky 961
ON RESTRICTED PARTITIONS AND A GENERALIZATION OF THE EULER φ NUMBER AND THE MOEBIUS FUNCTION. By Charles A. Nicol 963
CHARACTERIZATION OF QUADRATIC FORMS OVER LOCAL FIELDS. By O. T. O'Meara 969
THE AXIOM OF CHOICE IN QUINE'S NEW FOUNDATIONS FOR MATHEMATICAL LOGIC. By Ernst P. Specker 972
A GENERAL PRINCIPLE INVOLVING BAIRE CATEGORY, WITH APPLICATIONS TO FUNCTION THEORY AND OTHER FIELDS. By F. Bagemihl and W. Seidel 1068
ON A GENERALIZATION OF CLASSICAL PROBABILITY THEORY, I. MARKOFF CHAINS. By Richard Bellman 1075
SOME FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING. By Richard Bellman 1077
CLOSURE CLASSES ORIGINATING IN THE THEORY OF PROBABILITY. By S. Bochner 1082
COMPLETELY INTEGRABLE PARTIAL DIFFERENTIAL EQUATIONS IN NORMED LINEAR SPACES. By A. D. Michal 1089
STOCHASTIC GAMES. By L. S. Shapley 1095
EXISTENCE OF GENERALIZED LOCAL CLASS FIELDS. By G. Whaples 1100
HOMOLOGY AND COHOMOLOGY OF COMPACT CONNECTED LIE GROUPS. By Armand Borel 1142

SPIRAL AND OTHER ASYMPTOTIC PATHS, AND PATHS OF COMPLETE INDETERMINATION, OF ANALYTIC AND MEROMORPHIC FUNCTIONS *By F. Bagemihl and W. Seidel* 1251
THE GLOBAL BEHAVIOR OF DIFFERENTIAL EQUATIONS ON *N*-DIMENSIONAL MANIFOLDS *By Felix Haas* 1258
CONJUGATE NETS, CONFORMAL STRUCTURE, AND INTERIOR TRANSFORMATIONS ON OPEN RIEMANN SURFACES *By James Jenkins and Marston Morse* 1261
ON A DIFFERENTIAL-GEOMETRIC METHOD IN THE THEORY OF ANALYTIC STACKS *By K. Kodaira* 1268
ON A THEOREM OF LEFSCHETZ AND THE LEMMA OF ENRIQUES-SEVERI-ZARISKI *By K. Kodaira and D. C. Spencer* 1273
ON A NEW PROBLEM CONCERNING TRINOMIAL CONGRUENCES INVOLVING RATIONAL INTEGERS *By Erna H. Pearson and H. S. Vandiver* 1278

ASTRONOMY

MAGELLANIC CLOUDS, V. FIFTY ECLIPSING STARS *By Harlow Shapley and Virginia McKibben Nail* 1
NEW WHITE DWARFS IN THE SOUTHERN HEMISPHERE: THIRD LIST *By Willem J. Luyten* 135
MAGELLANIC CLOUDS, VI. REVISED DISTANCES AND LUMINOSITIES *By Harlow Shapley* 349
MAGELLANIC CLOUDS, VII. STAR COLORS AND LUMINOSITIES IN FIVE CONSTELLATIONS *By Virginia McKibben Nail and Harlow Shapley* 358
FREQUENCY OF SEPARATION AND OF INTERLOCKING OF CLUSTERS OF GALAXIES *By Jerzy Neyman and Elizabeth L. Scott* 737
SATELLITES, COMETS, AND INTERPLANETARY MATERIAL *By Gerard P. Kuiper* 1153
NOTE ON THE ORIGIN OF ASTEROIDS *By Gerard P. Kuiper* 1159
MAGELLANIC CLOUDS, VIII. ON THE POPULATION CHARACTERISTICS OF THE TWO CLOUDS *By Harlow Shapley* 1161
MAGELLANIC CLOUDS, IX. THE NEBULOSITIES OF THE SMALL CLOUD *By Virginia McK. Nail, Charles A. Whitney, and Campbell M. Wade* 1168

PHYSICS

A CLASSICAL MODEL OF A ROTON *By C. L. Pekeris* 443
GENERALIZED RIEMANN SPACES AND GENERAL RELATIVITY *By Luther P. Eisenhart* 546
A THEORY OF FERROMAGNETISM *By Linus Pauling* 551
EQUAL RATIOS OF ENERGIES OF NUCLEAR EXCITED STATES OF EVEN-EVEN ISOTOPES *By Martin G. Redlich* 560
IMAGE THEORY OF SUPERPOSED VECTOR SETS *By M. J. Buerger* 669
SOLUTION FUNCTIONS FOR SOLVING SUPERPOSED PATTERSON SYNTHESES *By M. J. Buerger* 674
AN INTERSECTION FUNCTION AND ITS RELATIONS TO THE MINIMUM FUNCTION OF X-RAY CRYSTALLOGRAPHY *By M. J. Buerger* 678
ABOUT SPACE-TIME ASYMMETRY IN THE REALM OF CLASSICAL GENERAL AND CRYSTAL PHYSICS *By H. Zocher and C. Török* 681
NUCLEAR REACTIONS WITH ENERGETIC NITROGEN IONS *By H. L. Reynolds, D. W. Scott, and A. Zucker* 975

ENGINEERING

ON THE INCLINATION OF PLASTIC SLIP BANDS IN FLAT BARS IN TENSION TESTS . *By T. Y. Thomas* 257
THE EFFECT OF COMPRESSIBILITY ON THE INCLINATION OF PLASTIC SLIP BANDS IN FLAT BARS . . . . . *By T. Y. Thomas* 266
NONLINEAR MULTIPOLES . . . . . *By L. A. Zadeh* 274
ON THE EFFECT OF PRETWISTING ON BENDING . . *By Francis D. Murnaghan* 1218

CHEMISTRY

PHENOMENA IN THE LIQUID-LIQUID CRITICAL REGION . . . . . *By George Jura, Don Fraga, Gilda Maki, and Joel H. Hildebrand* 19
CHROMATOGRAPHIC SEPARATION AND IDENTIFICATION OF SOME PEPTIDES IN PARTIAL HYDROLYSATES OF GELATIN . . . . . *By W. A. Schroeder, Lewis Honnen, and F. Charlotte Green* 23
A STUDY OF LIGNIN FORMATION BASED ON THE OXIDATION OF NATIVE AND ENZYMATICALLY LIBERATED LIGNIN . . *By George de Stevens and F. F. Nord* 80
A PROPOSED STRUCTURE FOR THE NUCLEIC ACIDS . . . . . *By Linus Pauling and Robert B. Corey* 84
A KINETIC TREATMENT OF SATURATION AND CONDENSATION STATISTICS . . . . *By Henry Eyring and Merrill Wallenstein* 138
THE HIGH FIELD CONDUCTANCE OF SOME SYMMETRICAL VALENCE-TYPE STRONG ELECTROLYTES . . . . . *By Andrew Patterson, Jr.* 146
THE SOLUBILITY OF THE DIMETHYLETHERATE OF ALUMINUM BROMIDE IN METHYL BROMIDE IN THE PRESENCE OF SATURATED HYDROCARBONS . . . . . *By Luther M. Foster and Charles A. Kraus* 236
THE POTENTIAL USEFULNESS OF NATURAL TRITIUM . . . . *By W. F. Libby* 245
TWO PLEATED-SHEET CONFIGURATIONS OF POLYPEPTIDE CHAINS INVOLVING BOTH CIS AND TRANS AMIDE GROUPS . *By Linus Pauling and Robert B. Corey* 247
TWO RIPPLED-SHEET CONFIGURATIONS OF POLYPEPTIDE CHAINS, AND A NOTE ABOUT THE PLEATED SHEETS . *By Linus Pauling and Robert B. Corey* 253
ENZYMES, SPECIFIC SUBSTRATES AND COMPETITIVE INHIBITORS AS MULTIFUNCTIONAL ENTITIES . . . . . *By Robert J. Foster and Carl Niemann* 371
HYDROGEN BONDED HELICAL CONFIGURATIONS OF THE POLYPEPTIDE CHAIN . . *By Jerry Donohue* 470
THE MOLECULAR WEIGHT OF SOME LONG CHAIN SALTS IN BENZENE BY THE CRYOSCOPIC METHOD . . . . . *By Charles H. Keith and Charles A. Kraus* 598
ACTION OF BORON TRIFLUORIDE ETHERATE ON β-CAROTENE . . . . . *By L. Wallcave, J. Leemann, and L. Zechmeister* 604
GENERALIZED MATHEMATICAL RELATIONSHIPS FOR POLYPEPTIDE CHAIN HELICES. THE COORDINATES OF THE II HELIX . . . . . *By Barbara W. Low and H. J. Grenville-Wells* 785
CONDUCTANCE AND VISCOSITY OF CONCENTRATED AQUEOUS SALT SOLUTIONS AT 50.5° . . . . . *By M. John Rice, Jr., and Charles A. Kraus* 802
THE CONDUCTANCE OF SOLUTIONS OF SALTS IN ORTHODICHLOROBENZENE . . *By Filippo Accascina, E. Lowell Swarts, Philip L. Mercier, and Charles A. Kraus* 917
THE VISCOSITY AND THE CONDUCTANCE-VISCOSITY PRODUCT OF ELECTROLYTE SOLUTIONS IN BROMINE . . *By M. John Rice, Jr., and Charles A. Kraus* 1118
THE BEHAVIOR OF MICELLAR ELECTROLYTES IN THE NEIGHBORHOOD OF THE CRITICAL CONCENTRATION . . . . . *By Charles A. Kraus* 1213

GEOPHYSICS

TRAVEL TIMES OF LONGITUDINAL WAVES FROM SURFACE FOCI . By B. Gutenberg 849
ON THE ORIGIN OF CONTINENTS AND MOUNTAINS . . . . . By Harold C. Urey 933

BOTANY

THE EFFECT OF AMMONIA ON MORPHOGENESIS IN THE *Acrasieae* . . . . . By Arthur L. Cohen 68
BIOMETRIC EVIDENCE OF NATURAL SELECTION IN *Asclepias Tuberosa* . . . . . By Robert E. Woodson, Jr. 74
THE EFFECT OF ULTRAVIOLET IRRADIATION ON CELL DIVISION AND ELONGATION IN TIMOTHY ROOTS . . . . . By Robert T. Brumfield 366
PULCHERRIMIN, THE PIGMENT OF *Candida Pulcherrima* . . . . . By A. J. Kluyver, J. P. van der Walt, and A. J. van Triet 583
TAXONOMIC SIGNIFICANCE OF ROOT-HAIR DEVELOPMENT IN THE *Gramineae* . . . By John R. Reeder and Kraft von Maltzahn 593
THE INTERACTION OF AUXIN AND LIGHT IN THE GROWTH RESPONSES OF PLANTS . By James L. Liverman and James Bonner 905
A THEORY OF AUXIN ACTION INVOLVING COENZYME A . . . . . By A. C. Leopold and Frances S. Guernsey 1105
EXPERIMENTAL COUPLING OF INDOLEACETIC ACID TO PEA ROOT PROTEIN IN VIVO AND IN VITRO . . . . . By S. M. Siegel and A. W. Galston 1111
EFFECT OF AMINO ACIDS, ESPECIALLY ASPARTIC AND GLUTAMIC ACID AND THEIR AMIDES, ON THE GROWTH OF *Datura Stramonium* EMBRYOS IN VITRO . . . By Denise Paris, J. Rietsema, S. Satina, and A. F. Blakeslee 1205

ZOOLOGY

ABNORMALITY OF DOWN PIGMENTATION ASSOCIATED WITH EXPERIMENTALLY PRODUCED SKELETAL DEFECTS OF CHICKS . . . . . By Walter Landauer 54
AN ANALYSIS OF THE SYNTHESIS AND DISTRIBUTION OF THE CONTRACTILE PROTEIN, MYOSIN, IN THE DEVELOPMENT OF THE HEART . By James D. Ebert 333
THE STRUCTURE OF THE MACRONUCLEUS OF *Paramecium Aurelia* . . . . . By R. F. Kimball 345
ACTION POTENTIALS FROM AN ARTHROPOD OCELLUS: THE MEDIAN EYE OF LIMULUS . . . . . By Talbot H. Waterman 687
THE GROWTH OF *Amblystoma* CHIMERAS . . . . . By Gilbert Church 877
DEVELOPMENT OF THE FINE STRUCTURE OF THE MYELIN SHEATH IN SCIATIC NERVES OF CHICK EMBRYOS . . By Betty Ben Geren and Josephine Raskind 880
ACOUSTIC ORIENTATION IN THE OIL BIRD, *Steatornis* . . . By Donald R. Griffin 884
THE DIFFERENTIATION OF GASTRULA ECTODERM IN MEDIUM CONDITIONED BY AXIAL MESODERM . . . . . By M. C. Niu and V. C. Twitty 985
THE DEVELOPMENT OF TRANSPLANTED FRAGMENTS OF *Fundulus* GASTRULAE . . By Jane M. Oppenheimer 1149
PHOSPHOMONOESTERASES IN REEF-BUILDING CORALS . . By Thomas F. Goreau 1291

GENETICS

VIABILITY OF HYBRIDS BETWEEN LOCAL POPULATIONS OF *Drosophila Pseudoobscura* . . . . . By M. Vetukhiv 30
INDUCED DOMINANT LETHALITY IN *Lilium* . . . . . By Spencer W. Brown and Marion S. Cave 97

KAPPA CONCENTRATION PER CELL IN RELATION TO THE LIFE CYCLE, GENOTYPE AND MATING TYPE IN *Paramecium Aurelia*, VARIETY 4 . *By P. K. Chao* 103
MATING TYPE DETERMINATION IN *Paramecium Aurelia*, A MODEL OF NUCLEO-CYTOPLASMIC INTERACTION . . . . . *By David L. Nanney* 113
THE BASIS OF THE OXYGEN EFFECT ON X-IRRADIATED DROSOPHILA SPERM . . . *By William K. Baker and Elizabeth S. Von Halle* 152
THE GENETICS OF HOMEOSTASIS IN DROSOPHILA . . . . . *By Th. Dobzhansky and Bruce Wallace* 162
HETEROGENEITY OF CLONES OF SACCHAROMYCES DERIVED FROM HAPLOID ASCOSPORES . . . . . *By Herschel Roman and Stanley M. Sands* 171
A STUDY OF MUTABILITY IN STREPTOMYCIN-DEPENDENT STRAINS OF *Escherichia Coli* . . . . . *By Edgar L. Labrum* 208
INDUCED POLLEN LETHALS FROM SEEDS OF *Datura Stramonium* TREATED WITH THERMAL NEUTRONS . . . . . *By J. L. Spencer, W. R. Singleton, and A. F. Blakeslee* 288
THE EFFECT OF THERMAL NEUTRON RADIATION ON THE CHROMOSOMES OF *Datura* *By Henry T. Yost, Jr., W. R. Singleton, and A. F. Blakeslee* 292
PAPER CHROMATOGRAPHIC PATTERNS OF GENETICALLY DIFFERENT TISSUES: A CONTRIBUTION TO THE BIOCHEMICAL STUDY OF INDIVIDUALITY . . . . *By Adriano A. Buzzati-Traverso* 376
ALLELES AT A MUTABLE LOCUS FOUND IN POPULATIONS OF WILD HOUSE MICE (*Mus Musculus*) . . . . . *By L. C. Dunn and W. C. Morgan, Jr.* 391
EFFECTS OF ALKALI METAL IONS ON DEVELOPMENT OF *Drosophila*, WITH SPECIAL REFERENCE TO LITHIUM-INDUCED ABNORMALITIES . . . *By Robert C. King* 403
SEROLOGICAL DIFFERENTIATION OF THE HOMOZYGOTES AND HETEROZYGOTES IN BACK-CROSS BIRDS FOLLOWING A SPECIES CROSS IN *Columbidae* . . . . *By W. J. Miller and C. R. Bryan* 407
INTERACTION BETWEEN ALLELES AFFECTING CELLULAR ANTIGENS FOLLOWING A SPECIES CROSS IN *Columbidae* . . . . *By C. R. Bryan and W. J. Miller* 412
GENETIC EXCHANGE IN *Escherichia Coli* K_{12}: EVIDENCE FOR THREE LINKAGE GROUPS . . . . . *By J. D. Watson and W. Hayes* 416
EFFECTS OF TEMPERATURE ON SPONTANEOUS AND INDUCED MUTATIONS IN *Escherichia Coli* . . . . . *By Evelyn M. Witkin* 427
THE EFFECT OF A SUPPRESSOR ON ALLELIC INOSITOLLESS MUTANTS IN *Neurospora Crassa* . . . . . *By Norman H. Giles and C. W. H. Partridge* 479
THE EFFECT OF PRETREATMENT WITH INFRA-RED RADIATION ON THE X-RAY INDUCED SEX-LINKED RECESSIVE LETHAL AND VISIBLE MUTATION RATE IN *Drosophila Melanogaster* . . . . . *By William J. Young, Henry T. Yost, Jr., P. T. Ives, and R. Paul Levine* 488
MENDELIAN AND NON-MENDELIAN FACTORS AFFECTING THE CYTOCHROME SYSTEM IN *Neurospora Crassa* . . . . . *By M. B. Mitchell, H. K. Mitchell, and A. Tissieres* 606
INDUCTION OF CHROMOSOME BREAKAGE AT MEIOSIS BY A MAGNESIUM DEFICIENCY IN *Tradescantia* . . . . . *By Dale Steffensen* 613
UNITY OF THE VEGETATIVE POOL IN PHAGE-INFECTED BACTERIA . . . . . *By N. Visconti and A. Garen* 620
INDUCTION OF MUTATIONS IN A BACTERIAL VIRUS . . . . . *By J. J. Weigle* 628
DEVELOPMENT AND GENETICS OF A SEX-INFLUENCED TRAIT IN THE LIVERS OF MICE . . . . . *By C. H. Danforth and Elizabeth Center* 811
MUTATION RATES AND LETHAL GENE FREQUENCIES IN POPULATIONS OF *Drosophila Melanogaster* . . . . . *By R. P. Levine and P. T. Ives* 817

ANTI-*f* AND THE "NEW" RH ANTIGEN IT DEFINES
By Ruth Sanger, R. R. Race, R. E. Rosenfield, P. Vogel, and Natalie Gibbel 824
FURTHER STUDIES ON THE EFFECTS OF CARBON DIOXIDE AND OXYGEN ON THE FREQUENCY OF X-RAY INDUCED CHROMOSOME ABERRATIONS IN TRADESCANTIA *By Howard A. Schneiderman and Edward D. King* 834
GENE ACTION IN RELATION TO GROWTH AND DEVELOPMENT. I. PHENOTYPIC VARIABILITY *By F. W. Went* 839
THE EFFECT OF INDOLE-3-ACETIC ACID ON DATURA EMBRYOS
By J. Rietsema, S. Satina, and A. F. Blakeslee 924
INDISPENSABLE GENE FUNCTIONS IN NEUROSPORA
By K. C. Atwood and Frank Mukai 1027
IMMUNOGENETIC STUDIES OF PSEUDOALLELISM IN *Drosophila Melanogaster*. I. ANTIGENIC EFFECTS OF THE LOZENGE PSEUDOALLELES
By Arthur Chovnick and Allen S. Fox 1035
A RELATIONSHIP OF HOMOCYSTEINE METABOLISM TO THIAMIN, SERINE, AND ADENINE BIOSYNTHESIS IN A MUTANT STRAIN OF NEUROSPORA
By C. O. Doudney and R. P. Wagner 1043
INDUCED HOST-RANGE MUTATIONS IN BACTERIOPHAGE
By Bernal Fernandez, Felix L. Haas, and Orville Wyss 1052
MATING TYPE DETERMINATION IN *Tetrahymena Pyriformis*
By David L. Nanney and Patricia A. Caughey 1057
THE EFFECT OF THE PREVIOUS GENERATION ON THE DISTRIBUTION OF GENE FREQUENCIES IN POPULATIONS *By Clifford S. Patlak* 1063
THE EFFECTS OF TEMPERATURE ON ULTRAVIOLET-INDUCED MUTABILITY IN *Escherichia Coli* *By Alexander M. M. Berrie* 1125
THE EFFECTS OF INFRA-RED RADIATION AND DESICCATION ON CROSSINGOVER IN *Drosophila Melanogaster*
By P. T. Ives, B. J. Fenton, H. T. Yost, Jr., and R. P. Levine 1134
THE EFFECT OF GENERATION TIME ON THE DELAYED APPEARANCE OF INDUCED MUTANTS IN *Escherichia Coli* *By Edgar L. Labrum* 1221
THE RELATIONSHIP BETWEEN KAPPA AND PARAMECIN IN *Paramecium Aurelia*
By John R. Preer, Jr., Richard W. Siegel, and Pearl S. Stark 1228
CROSS REACTIVATION OF GENETIC LOCI OF T2 BACTERIOPHAGE AFTER DECAY OF INCORPORATED RADIOACTIVE PHOSPHORUS *By Gunther S. Stent* 1234
EFFECT OF X-RAYS ON CHROMATID ABERRATIONS IN AIR AND IN NITROGEN
By C. P. Swanson and Drew Schwartz 1241

PHYSIOLOGY AND BIOCHEMISTRY

EVIDENCE FOR THE SYNTHESIS OF VITAMIN B_{12} BY SPONTANEOUS TUMORS
By D. W. Woolley 6
COMPARISON OF THE PHOSPHORUS CONTENT, OPTICAL ROTATION, SEPARATION OF HEMES AND GLOBIN, AND TERMINAL AMINO ACID RESIDUES OF NORMAL ADULT HUMAN HEMOGLOBIN AND SICKLE CELL ANEMIA HEMOGLOBIN
By E. Havinga 59
ELECTROPHORETIC STUDIES OF GLOBINS PREPARED FROM NORMAL ADULT AND SICKLE CELL HEMOGLOBINS *By E. Havinga and H. A. Itano* 65
A BIOCHEMICALLY SPECIFIC METHOD FOR ENZYME ISOLATION
By Leonard S. Lerman 232
SEROLOGICAL REACTIVITY OF SYNTHETIC POLYGLUCOSES
By Michael Heidelberger and Alan C. Aisenberg 453

A NEW PARTICLE TYPE IN CERTAIN CONNECTIVE TISSUE EXTRACTS . . . . . *By Francis O. Schmitt, Jerome Gross, and John H. Highberger* 459
THE EFFECT OF ANTIBIOTICS ON UREA BREAKDOWN IN MICE . . . . . *By Renee Z. Dintzis and A. Baird Hastings* 571
PATH OF ORNITHINE SYNTHESIS IN *Escherichia Coli* . . . . . *By Henry J. Vogel* 578
TRANSFER OF C^{14} BY LUPINE MITOCHONDRIA THROUGH REACTIONS OF THE TRICARBOXYLIC ACID CYCLE . . . . *By D. O. Brummond and R. H. Burris* 754
SUBCELLULAR FRACTIONATION OF MOUSE SPLEEN RADIATION PROTECTION ACTIVITY . . . . *By Leonard J. Cole, Maurice C. Fishler, and Victor P. Bond* 759
THE MECHANISM OF PROPIONIC ACID FORMATION BY SUCCINATE DECARBOXYLATION. I. THE ACTIVATION OF SUCCINATE . . . . . *By H. R. Whiteley* 772
THE MECHANISM OF PROPIONIC ACID FORMATION BY SUCCINATE DECARBOXYLATION. II. THE FORMATION AND DECARBOXYLATION OF SUCCINYL-CoA . . *By H. R. Whiteley* 779
ALTERATION OF THE KINETIC PROPERTIES OF AN ENZYME BY THE BINDING OF BUFFER, INHIBITOR, OR SUBSTRATE . . . . . *By Robert A. Alberty and Robert M. Bock* 895
A LIGHT ACTIVATION PHENOMENON IN THE ENZYMATIC AND NONENZYMATIC REDUCTION OF TETRAZOLIUM SALTS . . . . . *By Walter J. Nickerson and Joseph R. Merkel* 901
A SELECTIVE STAINING METHOD FOR THE BASIC PROTEINS OF CELL NUCLEI . . *By Max Alfert and Irving I. Geschwind* 991
THE EVALUATION OF THE KINETIC CONSTANTS OF ENZYME CATALYZED REACTIONS *By Robert J. Foster and Carl Niemann* 999
ACETYLATION OF GLUTAMIC ACID BY EXTRACTS OF *Escherichia Coli* . . . . . *By Werner K. Maas, G. David Novelli, and Fritz Lipmann* 1004
RELEASE OF MITOCHONDRIA FROM YEAST CELLS BY THE ACTION OF METAL-CHELATING AGENTS . . . *By Joseph R. Merkel and Walter J. Nickerson* 1008
THE ROLE OF THE TRICARBOXYLIC ACID CYCLE IN AMINO ACID SYNTHESIS IN *Escherichia Coli* . . . . . *By R. B. Roberts, D. B. Cowie, R. Britten, E. Bolton, and P. H. Abelson* 1013
SYNTHESIS OF THE ASPARTIC AND GLUTAMIC FAMILIES OF AMINO ACIDS IN *Escherichia Coli* . . . . . *By P. H. Abelson, E. Bolton, R. Britten, D. B. Cowie, and R. B. Roberts* 1020
THE ENZYMATIC SYNTHESIS OF PORPHYRINS FROM PORPHOBILINOGEN . . . . . *By Lawrence Bogorad and S. Granick* 1176
COMPETITION AMONG IONIC SPECIES IN CATION ACTIVATION OF ENZYMES . . . . *By C. E. Hagen and P. C. Jackson* 1188
ENZYMATIC REACTIONS IN PURINE DECOMPOSITION BY PREPARATIONS OF *Clostridium Acidi-Urici* . . . . . *By Norman S. Radin and H. A. Barker* 1196
MECHANOCHEMICAL PROPERTIES OF FIBERS OF SURFACE-SPREAD ACTOMYOSIN . *By Teru Hayashi and Raja Rosenbluth* 1285

PATHOLOGY AND BACTERIOLOGY

ORGANISMAL DIFFERENTIALS AND ORGAN DIFFERENTIALS . . . . *By Leo Loeb* 127
OXIDATION OF INTERMEDIATES OF THE TRICARBOXYLIC ACID CYCLE BY EXTRACTS OF *Azotobacter Agile* . . . . . *By Roy Repaske and P. W. Wilson* 225
AROMATIC BIOSYNTHESIS. VI. RESISTANCE TO INHIBITION BY AN ACCUMULATED METABOLITE, 5-DEHYDROSHIKIMIC ACID, AND ITS SIGNIFICANCE FOR THE MECHANISM OF DRUG RESISTANCE . . . . . *By Bernard D. Davis* 363

THE INFLUENCE OF TEMPERATURE UPON THE INACTIVATION OF A BACTERIAL VIRUS BY X-RAYS . . . . . *By C. S. Bachofer, C. F. Ehret, S. Mayer, and E. L. Powers* 744

ELECTRON MICROSCOPY OF THE NUCLEIC ACID RELEASED FROM INDIVIDUAL BACTERIOPHAGE PARTICLES . . . . . *By Dean Fraser and Robley C. Williams* 750

ASCITES TUMOR-VIRUS SYSTEM AS A BIOLOGICAL TOOL . . . . . *By Hilary Koprowski, Irena Koprowska, and Robert Love* 1147

PSYCHOLOGY

THE EFFECT UPON HEART RATE CONDITIONING OF RANDOMLY VARYING THE INTERVAL BETWEEN CONDITIONED AND UNCONDITIONED STIMULI . . . . . *By P. J. Bersh, W. N. Schoenfeld, and J. M. Notterman* 563

ERRATA

SUBCELLULAR FRACTIONATION OF MOUSE SPLEEN RADIATION PROTECTION ACTIVITY . . . . . *By Leonard J. Cole* 1152

LINEAR PARABOLIC DIFFERENTIAL EQUATIONS OF ARBITRARY ORDER; GENERAL BOUNDARY-VALUE PROBLEMS FOR ELLIPTIC EQUATIONS . . . . . *By Felix E. Browder* 1298

DEVELOPMENT AND GENETICS OF A SEX-INFLUENCED TRAIT IN THE LIVERS OF MICE . . . . . *By C. H. Danforth* 1298

INDEX

ABELSON, P. H., BOLTON, E., BRITTEN, R., COWIE, D. B., and ROBERTS, R. B. Synthesis of the Aspartic and Glutamic Families of Amino Acids in *Escherichia Coli*, 1020.

ABELSON, P. H. See Roberts, R. B., 1013.

ACCASCINA, F., SWARTS, E. L., MERCIER, P. L., and KRAUS, C. A. The Conductance of Solutions of Salts in Orthodichlorobenzene, 917.

Acoustic orientation (Griffin), 884.

Acrasieae (Cohen), 68.

Action potentials (Waterman), 687.

Actomyosin, properties of fibers of (Hayashi and Rosenbluth), 1285.

ADEM, J. Relations on Iterated Reduced Powers, 636.

Adenine biosynthesis (Doudney and Wagner), 1043.

AISENBERG, A. C. See Heidelberger, M., 453.

ALBERTY, R. A., and BOCK, R. M. Alteration of the Kinetic Properties of an Enzyme by the Binding of Buffer, Inhibitor, or Substrate, 895.

ALFERT, M., and GESCHWIND, I. I. A Selective Staining Method for the Basic Proteins of Cell Nuclei, 991.

Algebraic varieties (Kodaira and Spencer), 641, 868, 872.

Algebras, absolute valued (Wright), 330.

Alkali metals, effects on development of *Drosophila* (King), 403.

Aluminum bromide dimethyletherate (Foster and Kraus), 236.

Amblystoma, growth of chimeras (Church), 877.

Amino acids, synthesis in *E. coli* (Roberts, Cowie, Britten, Bolton, and Abelson), 1013; (Abelson, Bolton, Britten, Cowie, and Roberts), 1020; effect on *Datura stramonium* growth (Paris, Rietsema, Satina, and Blakeslee), 1205.

Ammonia, effect on morphogenesis (Cohen), 68.

Analytic stacks (Kodaira), 1268.

Anemia (Havinga), 59.

Anti-*f* (Sanger, Race, Rosenfield, Vogel, and Gibbel), 824.

Antibiotics, effect on urea breakdown (Dintzis and Hastings), 571.

Antigens (Chovnick and Fox), 1035; cellular (Bryan and Miller), 412; Rh (Sanger, Race, Rosenfield, Vogel, and Gibbel), 824.

Approximate methods in mathematics (Herzberger), 853.

Asclepias tuberosa (Woodson), 74.

Ascospores, haploid (Roman and Sands), 171.

Asteroids (Kuiper), 1159.

ATWOOD, K. C., and MUKAI, F. Indispensable Gene Functions in Neurospora, 1027.

Auxin (Liverman and Bonner), 905; (Rietsema, Satina, and Blakeslee), 924; (Leopold and Guernsey), 1105. *See also indoleacetic acid.*

Axiom of choice (Specker), 972.

Azotobacter agile (Repaske and Wilson), 225.

β-Carotene (Wallcave, Leemann, and Zechmeister), 604.

BACHOFER, C. S., EHRET, C. F., MAYER, S., and POWERS, E. L. The Influence of Temperature Upon the Inactivation of a Bacterial Virus by x-Rays, 744.

Bacteria, phage-infected (Visconti and Garen), 620.

Bacterial virus (Weigle), 628; (Bachofer, Ehret, Mayer, and Powers), 744.

Bacteriophage (Fraser and Williams), 750; (Fernandez, Haas, and Wyss), 1052; (Stent), 1234.

BAGEMIHL, F., and SEIDEL, W. A General Principle Involving Baire Category, with Applications to Function Theory and Other Fields, 1068.

——. Spiral and Other Asymptotic Paths, and Paths of Complete Indetermination, of Analytic and Meromorphic Functions, 1251.

Baire category (Bagemihl and Seidel), 1068.

BAKER, W. K., and VON HALLE, E. S. The Basis of the Oxygen Effect on x-Irradiated Drosophila Sperm, 152.

BARKER, H. A. See Radin, N. S., 1196.

BELLMAN, R. Bottleneck Problems and Dynamic Programming, 947.

——. On a Generalization of Classical Probability Theory, I. Markoff Chains, 1075.

——. Some Functional Equations in the Theory of Dynamic Programming, 1077.

BELLMAN, R., GLICKSBERG, I., and GROSS, O. On Some Variational Problems Occurring in the Theory of Dynamic Programming, 298.

Bending, effect of pretwisting on (Murnaghan), 1218.

BERRIE, A. M. M. The Effects of Temperature on Ultraviolet-Induced Mutability in *Escherichia Coli*, 1125.

BERSH, P. J., SCHOENFELD, W. N., and NOTTERMAN, J. M. The Effect Upon Heart Rate Conditioning of Randomly Varying the Interval Between

Conditioned and Unconditioned Stimuli, 563.
Biosynthesis, aromatic (Davis), 363; by neurospora (Doudney and Wagner), 1043.
BLAKESLEE, A. F. See Spencer, J. L., 288; Yost, H. T., Jr., 292; Rietsema, J., 924; Paris, D., 1205.
BOCHNER, S. Stochastic Processes with Finite and Non-finite Variance, 190.
——. Fourier Transforms of Time Series, 302.
——. Closure Classes Originating in the Theory of Probability, 1082.
BOCK, R. M. See Alberty, R. A., 895.
BOGORAD, L., and GRANICK, S. The Enzymatic Synthesis of Porphyrins from Porphobilinogen, 1176.
BOLTON, E. See Roberts, R. B., 1013; Abelson, P. H., 1020.
BOND, V. P. See Cole, L. J., 759.
BONNER, J. See Liverman, J. L., 905.
BOREL, A. Homology and Cohomology of Compact Connected Lie Groups, 1142.
Boron trifluoride etherate (Wallcave, Leemann, and Zechmeister), 604.
Bottleneck problems (Bellman), 947.
Boundary-value problems (Browder), 179, 185.
BRITTEN, R. See Roberts, R. B., 1013; Abelson, P. H., 1020.
Bromine, electrolyte solutions in (Rice and Kraus), 1118.
BROWDER, F. E. Assumption of Boundary Values and the Green's Function in the Dirichlet Problem for the General Linear Elliptic Equation, 179.
——. Linear Parabolic Differential Equations of Arbitrary Order; General Boundary-Value Problems for Elliptic Equations, 185, 1298.
——. On the Eigenfunctions and Eigenvalues of the General Linear Elliptic Differential Operator, 433.
BROWN, S. W., and CAVE, M. S. Induced Dominant Lethality in *Lilium*, 97.
Brownian motion (Kallianpur and Robbins), 525.
BRUMFIELD, R. T. The Effect of Ultraviolet Irradiation on Cell Division and Elongation in Timothy Roots, 366.
BRUMMOND, D. O., and BURRIS, R. H. Transfer of C^{14} by Lupine Mitochondria Through Reactions of the Tricarboxylic Acid Cycle, 754.
BRYAN, C. R. See Miller, W. J., 407.
BRYAN, C. R., and MILLER, W. J. Interaction Between Alleles Affecting Cellular Antigens Following a Species Cross in *Columbidae*, 412.
BUERGER, M. J. Image Theory of Superposed Vector Sets, 669.
——. Solution Functions for Solving Superposed Patterson Syntheses, 674.
——. An Intersection Function and Its Relations to the Minimum Function of x-Ray Crystallography, 678.
BURRIS, R. H. See Brummond, D. O., 754.
BUZZATI-TRAVERSO, A. A. Paper Chromatographic Patterns of Genetically Different Tissues: A Contribution to the Biochemical Study of Individuality, 376.

Candida pulcherrima (Kluyver, van der Walt, and van Triet), 583.
Carbon dioxide, effect on chromosome aberrations (Schneiderman and King), 834.
CAUGHEY, P. A. See Nanney, D. L., 1057.
CAVE, M. S. See Brown, S. W., 97.
Cell division (Brumfield), 366.
Cell nuclei, proteins of (Alfert and Geschwind), 991.
CENTER, E. See Danforth, C. H., 811.
Chains, Markov (Harris and Robbins), 860; (Bellman), 1075.
CHAO, P. K. Kappa Concentration per Cell in Relation to the Life Cycle, Genotype and Mating Type in *Paramecium Aurelia*, Variety 4, 103.
CHARNES, A. Constrained Games and Linear Programming, 639.
Chick embryos, development of myelin sheath in (Geren and Raskind), 880.
Chicks, skeletal defects of (Landauer), 54.
Chimeras in *amblystoma* (Church), 877.
Choice, axiom of (Specker), 972.
CHOVNICK, A., and FOX, A. S. Immunogenetic Studies of Pseudoallelism in *Drosophila Melanogaster*. I. Antigenic Effects of the Lozenge Pseudoalleles, 1035.
Chromatid aberrations, effect of x-rays on (Swanson and Schwartz), 1241.
Chromatography (Schroeder, Honnen, and Green), 23; of tissues (Buzzati-Traverso), 376.
Chromosome breakage (Steffensen), 613.
CHURCH, G. The Growth of *Amblystoma* Chimeras, 877.
Classes, cohomology (Steenrod), 217; closure (Bochner) 1082.
Clones of saccharomyces (Roman and Sands), 171.
Clostridium acidi-urici (Radin and Barker), 1196.
Closure classes (Bochner), 1082.
Coenzyme A (Leopold and Guernsey), 1105.
COHEN, A. L. The effect of Ammonia on Morphogenesis in the *Acrasieae*, 68.
COHEN, E. Representations by Cubic Congruences, 119.

Cohomology (Spencer), 660.
Cohomology classes (Steenrod), 217.
Cohomology groups (Kodaira), 865; (Borel), 1142.
COLE, L. J., FISHLER, M. C., and BOND, V. P. Subcellular Fractionation of Mouse Spleen Radiation Protection Activity, 759.
COLE, L. J. Subcellular Fractionation of Mouse Spleen Radiation Protection Activity, 1152.
Columbidae, crosses in (Bryan and Miller), 407; 412.
Comets (Kuiper), 1153.
Complex line bundles (Kodaira and Spencer), 868.
Compressibility, effect on slip bands (Thomas), 266.
Condensation, kinetics of (Eyring and Wallenstein), 138.
Conditioned stimuli (Bersh, Schoenfeld, and Notterman), 563.
Conductance, of electrolytes (Patterson), 146; of electrolytes in bromine (Rice and Kraus), 1118; of salt solutions (Rice and Kraus), 802; (Accascina, Swarts, Mercier, and Kraus), 917.
Congruences, cubic (Cohen), 119; trinomial (Pearson and Vandiver), 1278.
Continents, origin of (Urey), 933.
Corals (Goreau), 1291.
COREY, R. B. See Pauling, L., 84, 247, 253.
COWIE, D. B. See Roberts, R. B., 1013; Abelson, P. H., 1020.
Crossingover in *D. melanogaster* (Ives, Fenton, Yost, and Levine), 1134.
Crystal physics (Zocher and Torok), 681; (Buerger), 678.
Crystallography, x-ray (Buerger), 678.
Cytochrome system in *neurospora crassa* (Mitchell, Mitchell and Tissieres), 606.

DANFORTH, C. H., and CENTER, E. Development and Genetics of a Sex-Influenced Trait in the Livers of Mice, 811, 1298.
Datura stramonium (Spencer, Singleton and Blakeslee), 288; (Yost, Singleton, and Blakeslee), 292; embryos (Rietsema, Satina, and Blakeslee), 924; effect of amino acids on growth (Paris, Rietsema, Satina, and Blakeslee), 1205.
DAVIS, B. D. Aromatic Biosynthesis. VI. Resistance to Inhibition by an Accumulated Metabolite, 5-Dehydroshikimic Acid, and Its Significance for the Mechanism of Drug Resistance, 363.
Desiccation, effect on *D. melanogaster* (Ives, Fenton, Yost, and Levine), 1134.
Differential equations (Browder), 185; (Morrey), 201; (Haas), 1258; linear elliptic (Browder), 179, 185; linear parabolic (Browder), 185; partial (Michal), 1089.
Differential geometry (Rauch), 440.
DINTZIS, R. Z., and HASTINGS, A. B. The Effect of Antibiotics on Urea Breakdown in Mice, 571.
Dirichlet problem (Browder), 179.
Divisor class groups (Kodaira and Spencer), 872.
DOBZHANSKY, T., and WALLACE, B. The Genetics of Homeostasis in Drosophila, 162.
DONOHUE, J. Hydrogen Bonded Helical Configurations of the Polypeptide Chain, 470.
DOUDNEY, C. O., and WAGNER, R. P. A Relationship of Homocysteine Metabolism to Thiamin, Serine, and Adenine Biosynthesis in a Mutant Strain of Neurospora, 1043.
DOUGLAS, J. On the Basis Theorem for Finite Abelian Groups: IV, 307.
Drosophila melanogaster (Baker and Von Halle), 152; (Dobzhansky and Wallace), 162; (King), 403; (Young, Yost, Ives, and Levine), 488; (Levine and Ives), 817; (Chovnick and Fox), 1035; (Ives, Fenton, Yost, and Levine), 1134.
Drosophila persimilis (Dobzhansky and Wallace), 162.
Drosophila prosaltans (Dobzhansky and Wallace), 162.
Drosophila pseudoobscura (Vetukhiv), 30; (Dobzhansky and Wallace), 162.
Drug resistance, mechanism of (Davis), 363.
DUNN, L. C., and MORGAN, W. C., JR. Alleles at a Mutable Locus Found in Populations of Wild House Mice (*Mus Musculus*), 391.
DUNNE, J. See Otter, R., 310.
Dynamic programming (Bellman), 947, 1077; theory of (Bellman, Glicksberg, and Gross), 298.

Earthquake waves (Gutenberg), 849.
EBERT, J. D. An Analysis of the Synthesis and Distribution of the Contractile Protein, Myosin, in the Development of the Heart, 333.
ECKMANN, B. On Complexes with Operators, 35.
EHRET, C. F. See Bachofer, C. S., 744.
Eigenfunctions (Mautner), 49; (Browder), 433.
EISENHART, L. P. Generalized Riemann Spaces and General Relativity, 546.
Electrolytes, high field conductance of (Patterson), 146; micellar (Kraus),

1213; solutions in bromine (Rice and Kraus), 1118.
Electrophoresis (Havinga and Itano), 65.
Enriques-Severi-Zariski, lemma of (Kodaira and Spencer), 1273.
Enzymes (Foster and Niemann), 371; (Alberty and Bock), 895; (Nickerson and Merkel), 901; (Foster and Niemann), 999; (Bogorad and Granick) 1176; (Radin and Barker), 1196; cation activation of (Hagen and Jackson), 1188; isolation (Lerman), 232.
Equations, differential (Browder), 185; (Morrey), 201; linear elliptic (Browder), 179, 185; linear parabolic differential (Browder), 185; partial differential (Michal), 1089.
Ergodic theory (Harris and Robbins), 860.
Errata (Cole), 1152; (Browder), 1298; (Danforth), 1298.
Escherichia coli (Labrum), 280; (Watson and Hayes), 416; (Witkin), 427; (Vogel), 578; (Maas, Novelli, and Lipmann), 1004; (Roberts, Cowie, Britten, Bolton, and Abelson), 1013; (Abelson, Bolton, Britten, Cowie, and Roberts), 1020; (Berrie), 1125; induced mutants in (Labrum), 1221; streptomycin-dependent strains of (Labrum), 280.
Euler φ number (Nicol), 963.
EYRING, H., and WALLENSTEIN, M. A Kinetic Treatment of Saturation and Condensation Statistics, 138.

FAN, K. Minimax Theorems, 42.
FENTON, B. J. See Ives, P. T., 1134.
FERNANDEZ, B., HAAS, F. L., and WYSS, O. Induced Host-Range Mutations in Bacteriophage, 1052.
Ferromagnetism, theory of (Pauling), 551.
Fields, generalized local class (Whaples), 1100; local (O'Meara), 969.
FINN, R. A Property of Minimal Surfaces, 197.
FISHLER, M. C. See Cole, L. J., 759.
Foreign associates of N. A. S. (Wilson), 1295.
FOSTER, L. M., and KRAUS, C. A. The Solubility of the Dimethyletherate of Aluminum Bromide in Methyl Bromide in the Presence of Saturated Hydrocarbons, 236.
FOSTER, R. J., and NIEMANN, C. Enzymes, Specific Substrates and Competitive Inhibitors as Multifunctional Entities, 371.
———. The Evaluation of the Kinetic Constants of Enzyme-Catalyzed Reactions, 999.
Fourier transforms (Bochner), 302.
FOX, A. S. See Chovnick, A., 1035.
Fractionation of mouse spleen (Cole, Fishler, and Bond), 759.
FRAGA, D. See Jura, G., 19.
FRASER, D., and WILLIAMS, R. C. Electron Microscopy of the Nucleic Acid Released from Individual Bacteriophage Particles, 750.
Functions, almost periodic (Struble), 122; analytic and meromorphic (Bagemihl and Seidel), 1251; Green's (Browder), 179; idea of (Menger), 956; Moebius (Nicol), 963; theory (Bagemihl and Seidel), 1068.
Fundulus gastrulae, development of (Oppenheimer), 1149.

Galaxies, clusters of (Neyman and Scott), 737.
GALE, D. A Theory of N-Person Games with Perfect Information, 496.
GALSTON, A. W. See Siegel, S. M., 1111.
Games, stochastic (Shapley), 1095; theory of (Gale), 496; (Charnes), 639; with equilibrium points (Otter and Dunne), 310.
GAREN, A. See Visconti, N., 620.
Gastrula ectoderm, differentiation of (Niu and Twitty), 985.
Gelatin hydrolysates (Schroeder, Honnen, and Green), 23.
Gene, action in relation to growth and development (Went), 839; frequencies, lethal (Levine and Ives), 817; frequencies in populations (Patlak), 1063; functions in neurospora (Atwood and Mukai), 1027.
Generation time, effect on induced mutants in *E. coli* (Labrum), 1221.
GEREN, B. B., and RASKIND, J. Development of the Fine Structure of the Myelin Sheath in Sciatic Nerves of Chick Embryos, 880.
GESCHWIND, I. I. See Alfert, M., 991.
GIBBEL, N. See Sanger, R., 824.
GILES, N. H., and PARTRIDGE, C. W. H. The Effect of a Suppressor on Allelic Inositolless Mutants in *Neurospora Crassa*, 479.
GLICKSBERG, I. See Bellman, R., 298.
Globin (Havinga), 59; (Havinga and Itano), 65.
Glutamic acid, acetylation of (Maas, Novelli, and Lipmann), 1004.
GOREAU, T. F. Phosphomonoesterases in Reef-Building Corals, 1291.
Gramineae (Reeder and von Maltzahn), 593.
GRANICK, S. See Bogorad, L., 1176.
GREEN, F. C. See Schroeder, W. A., 23.
GRENVILLE-WELLS, H. J. See Low, B. W., 785.
GRIFFIN, D. R. Acoustic Orientation in the Oil Bird, *Steatornis*, 884.
GROSS, J. See Schmitt, F. O., 459.

GROSS, O. See Bellman, R., 298.
Groups, abelian (Douglas), 307; classical (Murnaghan), 48; cohomology (Kodaira), 865; complex line bundles (Kodaira and Spencer), 868; contraction of (Inonu and Wigner), 510; divisor class (Kodaira and Spencer), 872; homology (Steenrod), 213; (Borel), 1142; Lie (Borel), 1142; locally compact (Struble), 122; representations of (Inonu and Wigner), 510; symmetric (Steenrod), 213; unitary symplectic (Murnaghan), 324.
Growth responses of plants (Liverman and Bonner), 905.
GUERNSEY, F. S. See Leopold, A. C., 1105.
GUTENBERG, B. Travel Times of Longitudinal Waves from Surface Foci, 849.

HAAS, F. The Global Behavior of Differential Equations on N-Dimensional Manifolds, 1258.
HAAS, F. L. See Fernandez, B., 1052.
HAGEN, C. E., and JACKSON, P. C. Competition Among Ionic Species in Cation Activation of Enzymes, 1188.
HARARY, F., and UHLENBECK, G. E. On the Number of Husimi Trees, I, 315.
HARRIS, T. E., and ROBBINS, H. Ergodic Theory of Markov Chains Admitting an Infinite Invariant Measure, 860.
HASTINGS, A. B. See Dintzis, R. Z., 571.
HAVINGA, E. Comparison of the Phosphorus Content, Optical Rotation, Separation of Hemes and Globin, and Terminal Amino Acid Residues of Normal Adult Human Hemoglobin and Sickle Cell Anemia Hemoglobin, 59.
HAVINGA, E., and ITANO, H. A. Electrophoretic Studies of Globins Prepared from Normal Adult and Sickle Cell Hemoglobins, 65.
HAYASHI, T., and ROSENBLUTH, R. Mechanochemical Properties of Fibers of Surface-Spread Actomyosin, 1285.
HAYES, W. See Watson, J. D., 416.
Heart, myosin in development of (Ebert), 333.
Heart rate conditioning (Bersh, Schoenfeld, and Notterman), 563.
Heat conduction (Spencer), 327.
HEIDELBERGER, M., and AISENBERG, A. C. Serological Reactivity of Synthetic Polyglucoses, 453.
HEINS, M. Studies in the Conformal Mapping of Riemann Surfaces, I, 322.
Hemoglobin (Havinga), 59; (Havinga and Itano), 65.
HERZBERGER, M. Approximate Methods in Mathematics, 853.
HIGHBERGER, J. H. See Schmitt, F. O., 459.
HILDEBRAND, J. H. See Jura, G., 19.
HIRZEBRUCH, F. On Steenrod's Reduced Powers, the Index of Inertia, and the Todd Genus, 951.
HLAVATÝ, V. The Spinor Connection in the Unified Einstein Theory of Relativity, 501.
——. Connections Between Einstein's Two Unified Theories of Relativity, 507.
Homeostasis (Dobzhansky and Wallace), 162.
Homocysteine metabolism (Doudney and Wagner), 1043.
Homotopy theory (Spanier and Whitehead), 655.
HONNEN, L. See Schroeder, W. A., 23.
Husimi trees (Harary and Uhlenbeck), 315.
Hybrid viability (Vetukhiv), 30.
Hydrogen bonding (Donohue), 470.

Image theory of superposed vector sets (Buerger), 669.
Index of inertia (Hirzebruch), 951.
Individuality, biochemical (Buzzati-Traverso), 376.
Indoleacetic acid (Rietsema, Satina, and Blakeslee), 924; (Siegel and Galston), 1111.
Information theory (Gale), 496.
Infra-red, effect on *D. melanogaster* (Ives, Fenton, Yost, and Levine), 1134; effect on mutation rate (Young, Yost, Ives, and Levine), 488.
INONU, E., and WIGNER, E. P. On the Contraction of Groups and Their Representations, 510.
Integers, rational (Pearson and Vandiver), 1278.
Interplanetary material (Kuiper), 1153.
Irreflexive relations (Richardson), 649.
Isotopes, even-even (Redlich), 560; nuclear states of (Redlich), 560.
ITANO, H. A. See Havinga, E., 65.
IVES, P. T., FENTON, B. J., YOST, H. T., JR., and LEVINE, R. P. The Effects of Infra-Red Radiation and Desiccation on Crossingover in *Drosophila Melanogaster*, 1134.
IVES, P. T. See Young, W. J., 488; Levine, R. P., 817.

JACKSON, P. C. See Hagen, C. E., 1188.
JENKINS, J., and MORSE, M. Conjugate Nets, Conformal Structure, and Interior Transformations on Open Riemann Surfaces, 1261.
JURA, G., FRAGA, D., MAKI, G., and HILDEBRAND, J. H. Phenomena in the Liquid-Liquid Critical Region, 19.

Kähler varieties (Kodaira and Spencer), 868.
KALLIANPUR, G., and ROBBINS, H. Ergodic Property of the Brownian Motion Process, 525.
Kappa, in *paramecium* (Chao), 103; (Preer, Siegel, and Stark), 1228.
KEITH, C. H., and KRAUS, C. A. The Molecular Weight of Some Long Chain Salts in Benzene by the Cryoscopic Method, 598.
KIMBALL, R. F. The Structure of the Macronucleus of *Paramecium Aurelia*, 345.
Kinetic constants of enzyme-catalyzed reactions (Foster and Niemann), 999.
KING, E. D. See Schneiderman, H. A., 834.
KING, R. C. Effects of Alkali Metal Ions on Development of *Drosophila*, with Special Reference to Lithium-Induced Abnormalities, 403.
KLUYVER, A. J., VAN DER WALT, J. P., and VAN TRIET, A. J. Pulcherrimin, the Pigment of *Candida Pulcherrima*, 583.
KODAIRA, K. On Cohomology Groups of Compact Analytic Varieties with Coefficients in Some Analytic Faisceaux, 865.
——. On a Differential-Geometric Method in the Theory of Analytic Stacks, 1268.
KODAIRA, K., and SPENCER, D. C. On Arithmetic Genera of Algebraic Varieties, 641.
——. Groups of Complex Line Bundles Over Compact Kähler Varieties, 868.
——. Divisor Class Groups on Algebraic Varieties, 872.
——. On a Theorem of Lefschetz and the Lemma of Enriques-Severi-Zariski, 1273.
KOPROWSKA, I. See Koprowski, H., 1147.
KOPROWSKI, H., KOPROWSKA, I., and LOVE, R. Ascites Tumor-Virus System as a Biological Tool, 1147.
KRAUS, C. A. The Behavior of Micellar Electrolytes in the Neighborhood of the Critical Concentration, 1213.
KRAUS, C. A. See Foster, L. M., 236; Keith, C. H., 598; Rice, M. J., Jr., 802, 1118; Accascina, F., 917.
KUIPER, G. P. Satellites, Comets, and Interplanetary Material, 1153.
——. Note on the Origin of the Asteroids, 1159.

LABRUM, E. L. A Study of Mutability in Streptomycin-Dependent Strains of *Escherichia Coli*, 280.
——. The Effect of Generation Time on the Delayed Appearance of Induced Mutants in *Escherichia Coli*, 1221.
LANDAUER, W. Abnormality of Down Pigmentation Associated with Experimentally Produced Skeletal Defects of Chicks, 54.
LEEMANN, J. See Wallcave, L., 604.
Lefschetz, theorem of (Kodaira and Spencer), 1273.
LEOPOLD, A. C., and GUERNSEY, F. S. A Theory of Auxin Action Involving Coenzyme A, 1105.
LERMAN, L. S. A Biochemically Specific Method for Enzyme Isolation, 232.
LEVINE, R. P. See Young, W. J., 488; Ives, P. T., 1134.
LEVINE, R. P., and IVES, P. T. Mutation Rates and Lethal Gene Frequencies in Populations of *Drosophila Melanogaster*, 817.
LIBBY, W. F. The Potential Usefulness of Natural Tritium, 245.
Light activation (Nickerson and Merkel), 901.
Lignin (de Stevens and Nord), 80.
Lilium, induced dominant lethality in (Brown and Cave), 97.
Limulus, median eye of (Waterman), 687.
LIPMANN, F. See Maas, W. K., 1004.
Liquids (Jura, Fraga, Maki, and Hildebrand), 19.
Lithium, effects on development of *drosophila* (King), 403.
LIVERMAN, J. L., and BONNER, J. The Interaction of Auxin and Light in the Growth Responses of Plants, 905.
LOEB, L. Organismal Differentials and Organ Differentials, 127.
Logarithm tables, checking of (Uhler), 533.
Longitudinal waves, travel times of (Gutenberg), 849.
LOVE, R. See Koprowski, H., 1147.
LOW, B. W., and GRENVILLE-WELLS, H. J. Generalized Mathematical Relationships for Polypeptide Chain Helices. The Coordinates of the π Helix, 785.
Lozenge pseudoalleles (Chovnick and Fox), 1035.
Lupine mitochondria (Brummond and Burris), 754.
LUYTEN, W. J. New White Dwarfs in the Southern Hemisphere: Third List, 135.

MAAS, W. K., NOVELLI, G. D., and LIPMANN, F. Acetylation of Glutamic Acid by Extracts of *Escherichia Coli*, 1004.
Magellanic clouds (Shapley and Nail), 1; (Shapley), 349, 1161; (Nail and Shapley), 358; (Nail, Whitney, and Wade), 1168.
Magnesium deficiency in *tradescantia* (Steffensen), 613.

MAKI, G. See Jura, G., 19.
Manifolds, Riemannian (Spencer), 327; n-dimensional (Haas), 1258.
Mapping, conformal (Heins), 322.
Markov chains (Harris and Robbins), 860; (Bellman), 1075.
Mathematical logic (Specker), 972.
Mating type determination, in *Paramecium aurelia* (Nanney), 113; in *Tetrahymena pyriformis* (Nanney and Caughey), 1057.
Matrices (Motzkin and Taussky), 961.
MAUTNER, F. I. On Eigenfunction Expansions, 49.
MAYER, S. See Bachofer, C. S., 744.
Meiosis, chromosome breakage at (Steffensen), 613.
MENGER, K. The Ideas of Variable and Function, 956.
MERCIER, P. L. See Accascina, F., 917.
MERKEL, J. R. See Nickerson, W. J., 901.
MERKEL, J. R., and NICKERSON, W. J. Release of Mitochondria from Yeast Cells by the Action of Metal-Chelating Agents, 1008.
Mesoderm, axial (Niu and Twitty), 985.
Metal-chelating agents (Merkel and Nickerson), 1008.
Methyl bromide, solubility of aluminum bromide dimethyletherate (Foster and Kraus), 236.
Mice, genetics of (Dunn and Morgan), 391; genetics of sex-influenced trait in (Danforth and Center), 811; spleen (Cole, Fishler, and Bond), 759; urea breakdown in (Dintzis and Hastings), 571.
Micellar electrolytes (Kraus), 1213.
MICHAL, A. D. Completely Integrable Partial Differential Equations in Normed Linear Spaces, 1089.
MILLER, W. J. See Bryan, C. R., 412.
MILLER, W. J., and BRYAN, C. R. Serological Differentiation of the Homozygotes and Heterozygotes in Back-Cross Birds Following a Species Cross in *Columbidae*, 407.
Minimax theorems (Fan), 42.
MITCHELL, H. K. See Mitchell, M. B., 606.
MITCHELL, M. B., MITCHELL, H. K., and TISSIERES, A. Mendelian and Non-Mendelian Factors Affecting the Cytochrome System in *Neurospora Crassa*, 606.
Mitochondria (Merkel and Nickerson), 1008; lupine (Brummond and Burris), 754.
Moebius function (Nicol), 963.
Molecular weight of long chain salts (Keith and Kraus), 598.
MOORE, R. L. Spirals in the Plane, 207.
MORGAN, W. C., JR. See Dunn, L. C., 391.
Morphogenesis of *Acrasieae* (Cohen), 68.
MORREY, C. B., JR. Second Order Elliptic Systems of Differential Equations, 201.
MORSE, M. See Jenkins, J., 1261.
MOTZKIN, T. S., and TAUSSKY, O. Pairs of Matrices with Property *L*, 961.
Mountains, origin of (Urey), 933.
MUKAI, F. See Atwood, K. C., 1027.
Multipoles, nonlinear (Zadeh), 274.
MURNAGHAN, F. D. On the Poincaré Polynomials of the Classical Groups—Addendum, 48.
——. The Parametrisation and Element of Volume of the Unitary Symplectic Group, 324.
——. On the Effect of Pretwisting on Bending, 1218.
Mutations, effect of infra-red on (Young, Yost, Ives, and Levine), 488; effects of temperature on (Witkin), 427; host-range (Fernandez, Haas, and Wyss), 1052; in a bacterial virus (Weigle), 628; in *D. melanogaster* (Levine and Ives), 817; in *E. coli* (Labrum), 280, 1221; inositolless (Giles and Partridge), 479; ultraviolet-induced (Berrie), 1125; x-ray induced (Young, Yost, Ives, and Levine), 488.
Myelin sheath, development of in chick embryos (Geren and Raskind), 880.
Myosin, synthesis and distribution of in heart development (Ebert), 333.

N-dimensional manifolds (Haas), 1258.
NAIL, V. McK. See Shapley, H., 1.
NAIL, V. McK., and SHAPELY, H. Magellanic Clouds, VII. Star Colors and Luminosities in Five Constellations, 358.
NAIL, V. McK., WHITNEY, C. A., and WADE, C. M. Magellanic Clouds, IX. The Nebulosities of the Small Cloud, 1168.
NANNEY, D. L. Mating Type Determination in *Paramecium Aurelia*, a Model of Nucleo-Cytoplasmic Interaction, 113.
NANNEY, D. L., and CAUGHEY, P. A. Mating Type Determination in *Tetrahymena Pyriformis*, 1057.
NATIONAL ACADEMY OF SCIENCES: Organization—Officers, Council Members, Members, Foreign Associates, Sections, Committees, Trust Funds, 695; Foreign Associates (Wilson), 1295.
Natural selection (Woodson), 74.
Neurospora crassa (Giles and Partridge), 479; (Mitchell, Mitchell, and Tissieres), 606; (Atwood and Mukai), 1027; (Doudney and Wagner), 1043.

Neutrons, thermal (Spencer, Singleton and Blakeslee), 288; (Yost, Singleton, and Blakeslee), 292.
NEYMAN, J., and SCOTT, E. L. Frequency of Separation and of Interlocking of Clusters of Galaxies, 737.
NICKERSON, W. J. See Merkel, J. R., 1008.
NICKERSON, W. J., and MERKEL, J. R. A Light Activation Phenomenon in the Enzymatic and Nonenzymatic Reduction of Tetrazolium Salts, 901.
NICOL, C. A. On Restricted Partitions and a Generalization of the Euler φ Number and the Moebius Function, 963.
NIEMANN, C. See Foster, R. J., 371, 999.
Nitrogen ions, energetic (Reynolds, Scott, and Zucker), 975.
NIU, M. C., and TWITTY, V. C. The Differentiation of Gastrula Ectoderm in Medium Conditioned by Axial Mesoderm, 985.
NORD, F. F. See Stevens, G. de, 80.
NOTTERMAN, J. M. See Bersh, P. J., 563.
NOVELLI, G. D. See Maas, W. K., 1004.
Nuclear reactions (Reynolds, Scott, and Zucker), 975.
Nucleic acids (Pauling and Corey), 84; (Fraser and Williams), 750.
Nucleo-cytoplasmic interaction (Nanney), 113.

Oil bird, acoustic orientation in (Griffin), 884.
O'MEARA, O. T. Characterization of Quadratic Forms Over Local Fields, 969.
Operations, reduced power (Steenrod), 213, 217.
Operators (Eckmann), 35; linear elliptic differential (Browder), 433.
OPPENHEIMER, J. M. The Development of Transplanted Fragments of *Fundulus* Gastrulae, 1149.
Optical rotation of hemoglobin (Havinga), 59.
Organ differentials and organismal differentials (Loeb), 127.
Orientation, acoustic (Griffin), 884.
Ornithine synthesis (Vogel), 578.
OTTER, R., and DUNNE, J. Games with Equilibrium Points, 310.
Oxygen, effect on chromosome aberrations (Schneiderman and King), 834; effect on x-irradiation (Baker and Von Halle), 152.

H Helix polypeptides (Low and Grenville-Wells), 785.
Paramecin, in *Paramecium aurelia* (Preer, Siegel, and Stark), 1228.
Paramecium aurelia (Nanney), 113; (Kimball), 345; kappa and paramecin in (Preer, Siegel, and Stark), 1228; macronucleus of (Kimball), 345; variety 4 (Chao), 103.
PARIS, D., RIETSEMA, J., SATINA, S., and BLAKESLEE, A. F. Effect of Amino Acids, Especially Aspartic and Glutamic Acid and Their Amides, on the Growth of *Datura Stramonium* Embryos in Vitro, 1205.
Partial differential equations (Michal), 1089.
Partitions, restricted (Nicol), 963.
PARTRIDGE, C. W. H. See Giles, N. H., 479.
PATLAK, C. S. The Effect of the Previous Generation on the Distribution of Gene Frequencies in Populations, 1063.
PATTERSON, A., JR. The High Field Conductance of Some Symmetrical Valence-type Strong Electrolytes, 146.
Patterson syntheses, superposed (Buerger), 674.
PAULING, L. A Theory of Ferromagnetism, 551.
PAULING, L., and COREY, R. B. A Proposed Structure for the Nucleic Acids, 84.
——. Two Pleated-Sheet Configurations of Polypeptide Chains Involving Both Cis and Trans Amide Groups, 247.
——. Two Rippled-Sheet Configurations of Polypeptide Chains, and a Note about the Pleated Sheets, 253.
Pea root protein (Siegel and Galston), 1111.
PEARSON, E. H., and VANDIVER, H. S. On a New Problem Concerning Trinomial Congruences Involving Rational Integers, 1278.
PEKERIS, C. L. A Classical Model of a Roton, 443.
Peptides (Schroeder, Honnen, and Green), 23.
Phage-infected bacteria (Visconti and Garen), 620.
Phenotypic variability (Went), 839.
Phosphomonoesterases in corals (Goreau), 1291.
Phosphorus content of hemoglobin (Havinga), 59.
Phosphorus, radioactive, in bacteriophage (Stent), 1234.
Pigmentation abnormality (Landauer), 54.
Poincaré polynomials (Murnaghan), 48.
Polyglucoses, synthetic (Heidelberger and Aisenberg), 453.
Polynomials (Murnaghan), 48.
Polypeptides (Pauling and Corey), 247, 253; (Donohue), 470; (Low and Grenville-Wells), 785.

Porphobilinogen (Bogorad and Granick), 1176.
Porphyrins, enzymatic synthesis of (Bogorad and Granick), 1176.
POWERS, E. L. See Bachofer, C. S., 744.
Powers, iterated reduced (Adem), 636; Steenrod's reduced (Hirzebruch), 951.
PREER, J. R., JR., SIEGEL, R. W., and STARK, P. S. The Relationship Between Kappa and Paramecin in *Paramecium Aurelia*, 1228.
Pretwisting, effect on bending (Murnaghan), 1218.
Probability theory (Bellman), 1075; (Bochner), 1082.
Programming, dynamic (Bellman), 947, 1077; linear (Charnes), 639.
Propionic acid formation by succinate decarboxylation (Whiteley), 772, 779.
Proteins of cell nuclei, staining of (Alfert and Geschwind), 991.
Pseudoallelism in *D. Melanogaster* (Chovnick and Fox), 1035.
Pulcherrimin (Kluyver, van der Walt, and van Triet), 583.
Purine, enzymatic decomposition of (Radin and Barker), 1196.

Quadratic forms (O'Meara), 969.

RACE, R. R. See Sanger, R., 824.
Radiation protection activity, mouse spleen (Cole, Fishler, and Bond), 759.
RADIN, N. S., and BARKER, H. A. Enzymatic Reactions in Purine Decomposition by Preparations of *Clostridium Acidi-Urici*, 1196.
RASKIND, J. See Geren, B. B., 880.
RAUCH, H. E. On Differential Geometry in the Large, 440.
REDLICH, M. G. Equal Ratios of Energies of Nuclear Excited States of Even-Even Isotopes, 560.
REEDER, J. R., and VON MALTZAHN, K. Taxonomic Significance of Root-Hair Development in the Gramineae, 593.
Relativity theory (Hlavatý), 501, 507; (Eisenhart), 546.
REPASKE, R., and WILSON, P. W. Oxidation of Intermediates of the Tricarboxylic Acid Cycle by Extracts of *Azotobacter Agile*, 225.
REYNOLDS, H. L., SCOTT, D. W., and ZUCKER, A. Nuclear Reactions with Energetic Nitrogen Ions, 975.
Rh antigen (Sanger, Race, Rosenfield, Vogel, and Gibbel), 824.
RICE, M. J., JR., and KRAUS, C. A. Conductance and Viscosity of Concentrated Aqueous Salt Solutions at 50.5°, 802.
——. The Viscosity and the Conductance-Viscosity Product of Electrolyte Solutions in Bromine, 1118.
RICHARDSON, M. Extension Theorems for Solutions of Irreflexive Relations, 649.
Riemann-Roch theorem (Spencer), 660.
Riemann spaces (Eisenhart), 546.
Riemann surfaces (Jenkins and Morse), 1261.
Riemannian manifolds (Spencer), 327.
RIETSEMA, J. See Paris, D., 1205.
RIETSEMA, J., SATINA, S., and BLAKESLEE, A. F. The Effect of Indole-3-Acetic Acid on Datura Embryos, 924.
ROBBINS, H. See Kallianpur, G., 525; Harris, T. E., 860.
ROBERTS, R. B. See Abelson, P. H., 1020.
ROBERTS, R. B., COWIE, D. B., BRITTEN, R., BOLTON, E., and ABELSON, P. H. The Role of the Tricarboxylic Acid Cycle in Amino Acid Synthesis in *Escherichia Coli*, 1013.
ROMAN, H., and SANDS, S. M. Heterogeneity of Clones of Saccharomyces Derived from Haploid Ascospores, 171.
Root-hair development (Reeder and von Maltzahn), 593.
ROSENBLUTH, R. See Hayashi, T., 1285.
ROSENFIELD, R. E. See Sanger, R., 824.
Roton (Pekeris), 443.

Saccharomyces (Roman and Sands,) 171.
Salts, conductance and viscosity of solutions (Rice and Kraus), 802; conductance in orthodichlorobenzene (Accascina, Swarts, Mercier, and Kraus), 917; long chain (Keith and Kraus), 598; tetrazolium (Nickerson and Merkel), 901.
SANDS, S. M. See Roman, H., 171.
SANGER, R., RACE, R. R., ROSENFIELD, R. E., VOGEL, P., and GIBBEL, N. Anti-*f* and the "New" Rh Antigen it Defines, 824.
Satellites (Kuiper), 1153.
SATINA, S. See Rietsema, J., 924; Paris, D., 1205.
Saturation, kinetics of (Eyring and Wallenstein), 138.
SCHMITT, F. O., GROSS, J., and HIGHBERGER, J. H. A New Particle Type in Certain Connective Tissue Extracts, 459.
SCHNEIDERMAN, H. A., and KING, E. D. Further Studies on the Effects of Carbon Dioxide and Oxygen on the Frequency of x-ray Induced Chromosome Aberrations in Tradescantia, 834.
SCHOENFELD, W. N. See Bersh, P. J., 563.
SCHROEDER, W. A., HONNEN, L., and GREEN, F. C. Chromatographic Separation and Identification of Some Peptides in Partial Hydrolysates of Gelatin, 23.

SCHWARTZ, D. See Swanson, C. P., 1241.
SCOTT, D. W. See Reynolds, H. L., 975.
SCOTT, E. L. See Neyman, J., 737.
SEIDEL, W. See Bagemihl, F., 1068, 1251.
Serine biosynthesis (Doudney and Wagner), 1043.
Serological differentiation (Miller and Bryan), 407.
Serological reactivity of synthetic polyglucoses (Heidelberger and Aisenberg), 453.
Sex-influenced trait in mice (Danforth and Center), 811.
SHAPLEY, H. See Nail, V. McK., 358.
SHAPLEY, H. Magellanic Clouds, VI. Revised Distances and Luminosities, 349.
——. Magellanic Clouds, VIII. On the Population Characteristics of the Two Clouds, 1161.
SHAPLEY, H., and NAIL, V. McK. Magellanic Clouds, V. Fifty Eclipsing Stars, 1.
SHAPLEY, L. S. Stochastic Games, 1095.
Sickle cell anemia (Havinga), 59; (Havinga and Itano), 65.
SIEGEL, R. W. See Preer, J. R., Jr., 1228.
SIEGEL, S. M., and GALSTON, A. W. Experimental Coupling of Indoleacetic Acid to Pea Root Protein In Vivo and In Vitro, 1111.
Significance levels (Wilson), 537.
SINGLETON, W. R. See Spencer, J. L., 288; Yost, H. T., Jr., 292.
Skeletal defects (Landauer), 54.
Skew distribution (Wilson), 537.
Slip bands, effect of compressibility on (Thomas), 266; in tension tests (Thomas), 257.
Space-time asymmetry (Zocher and Torok), 681.
Spaces, normed linear (Michal), 1089.
SPANIER, E. H., and WHITEHEAD, J. H. C. A First Approximation to Homotopy Theory, 655.
SPECKER, E. P. The Axiom of Choice in Quine's "New Foundations for Mathematical Logic," 972.
SPENCER, D. C. See Kodaira, K., 641, 868, 872, 1273.
SPENCER, D. C. Heat Conduction on Arbitrary Riemannian Manifolds, 327.
——. Cohomology and the Riemann-Roch Theorem, 660.
SPENCER, J. L., SINGLETON, W. R., and BLAKESLEE, A. F. Induced Pollen Lethals from Seeds of *Datura Stramonium* Treated with Thermal Neutrons, 288.
Spinors (Hlavatý), 501.
Spiral paths of functions (Bagemihl and Seidel), 1251.
Spirals in the plane (Moore), 207.
Staining methods (Alfert and Geschwind), 991.
STARK, P. S. See Preer, J. R., Jr., 1228.
Stars, eclipsing (Shapley and Nail), 1; white dwarf (Luyten), 135.
Statistics, saturation and condensation (Eyring and Wallenstein), 138.
Steatornis (Griffin), 884.
STEENROD, N. E. Homology Groups of Symmetric Groups and Reduced Power Operations, 213.
——. Cyclic Reduced Powers of Cohomology Classes, 217.
STEFFENSEN, D. Induction of Chromosome Breakage at Meiosis by a Magnesium Deficiency in *Tradescantia*, 613.
STENT, G. S. Cross Reactivation of Genetic Loci of T2 Bacteriophage After Decay of Incorporated Radioactive Phosphorus, 1234.
DE STEVENS, G., and NORD, F. F. A Study of Lignin Formation Based on the Oxidation of Native and Enzymatically Liberated Lignins, 80.
Stimuli, conditioned and unconditioned (Bersh, Schoenfeld, and Notterman), 563.
Stochastic games (Shapley), 1095.
Stochastic processes (Bochner) 190.
STRUBLE, R. A. Almost Periodic Functions on Locally Compact Groups, 122.
Succinate decarboxylation (Whiteley), 772, 779.
Succinyl-CoA (Whiteley), 779.
Surfaces, minimal (Finn), 197; Riemann (Heins), 322; (Jenkins and Morse), 1261.
SWANSON, C. P., and SCHWARTZ, D. Effect of x-Rays on Chromatid Aberrations in Air and in Nitrogen, 1241.
SWARTS, E. L. See Accascina, F., 917.

TAUSSKY, O. See Motzkin, T. S., 961.
Tension tests, inclination of slip bands in (Thomas), 257.
Tetrahymena pyriformis (Nanney and Caughey), 1057.
Tetrazolium salts, reduction of (Nickerson and Merkel), 901.
Thermal neutrons (Spencer, Singleton, and Blakeslee), 288; (Yost, Singleton, and Blakeslee), 292.
Thiamin biosynthesis (Doudney and Wagner), 1043.
THOMAS, T. Y. On the Inclination of Plastic Slip Bands in Flat Bars in Tension Tests, 257.
——. The Effect of Compressibility on the Inclination of Plastic Slip Bands in Flat Bars, 266.

Time series, fourier transforms of (Bochner), 302.
Timothy roots, cell division in (Brumfield), 366.
TISSIERES, A. See Mitchell, M. B., 606.
Tissue, connective (Schmitt, Gross and Highberger), 459.
Todd genus (Hirzebruch) 951.
TÖRÖK, C. See Zocher, H., 681.
Tradescantia (Steffensen), 613; chromosome aberrations in (Schneiderman and King), 834.
Tricarboxylic acid cycle (Repaske and Wilson), 225; (Brummond and Burris), 754; (Roberts, Cowie, Britten, Bolton, and Abelson), 1013.
Tritium, natural (Libby), 245.
Tumors (Woolley), 6.
Tumor-virus system (Koprowski, Koprowska, and Love), 1147.
Twisting, effect on bending (Murnaghan), 1218.
TWITTY, V. C. See Niu, M. C., 985.

UHLENBECK, G. E. See Harary, F., 315.
UHLER, H. S. Omnibus Checking of the 61-Place Table of Denary Logarithms Compiled by Peters and Stein, by Callet, and by Parkhurst, 533.
Ultraviolet, effect on cell division (Brumfield), 366.
Ultraviolet-induced mutability, effects of temperature on (Berrie), 1125.
Urea breakdown, effect of antibiotics on (Dintzis and Hastings), 571.
UREY, H. C. On the Origin of Continents and Mountains, 933.

VAN DER WALT, J. P. See Kluyver, A. J., 583.
VANDIVER, H. S. See Pearson, E. H., 1278.
VAN TRIET, A. J. See Kluyver, A. J., 583.
Variable, idea of (Menger), 956.
Vector sets, superposed (Buerger), 669.
Vegetative pool in bacteria (Visconti and Garen), 620.
VETUKHIV, M. Viability of Hybrids between Local Populations of *Drosophila Pseudoobscura*, 30.
Virus, bacterial (Weigle), 628; (Bachofer, Ehret, Mayer, and Powers), 744.
Viruses and tumors (Koprowski, Koprowska, and Love), 1147.
VISCONTI, N., and GAREN, A. Unity of the Vegetative Pool in Phage-Infected Bacteria, 620.
Viscosity, of electrolytes in bromine (Rice and Kraus), 1118; of salt solutions (Rice and Kraus), 802.
Vital statistics (Wilson), 1295.
Vitamin B_{12} (Woolley), 6.
VOGEL, H. J. Path of Ornithine Synthesis in *Escherichia Coli*, 578.
VOGEL, P. See Sanger, R., 824.
VON HALLE, E. S. See Baker, W. K., 152.
VON MALTZAHN, K. See Reeder, J. R., 593.

WADE, C. M. See Nail, V. McK., 1168.
WAGNER, R. P. See Doudney, C. O., 1043.
WALLACE, B. See Dobzhansky, T., 162.
WALLCAVE, L., LEEMANN, J., and ZECHMEISTER, L. Action of Boron Trifluoride Etherate on β-Carotene, 604.
WALLENSTEIN, M. See Evring, H., 138.
WATERMAN, T. H. Action Potentials from an Arthropod Ocellus: The Median Eye of Limulus, 687.
WATSON, J. D., and HAYES, W. Genetic Exchange in *Escherichia Coli* K_{12}: Evidence for Three Linkage Groups, 416.
WEIGLE, J. J. Induction of Mutations in a Bacterial Virus, 628.
WENT, F. W. Gene Action in Relation to Growth and Development. I. Phenotypic Variability, 839.
WHAPLES, G. Existence of Generalized Local Class Fields, 1100.
White dwarf stars (Luyten), 135.
WHITEHEAD, J. H. C. See Spanier, E. H., 655.
WHITELEY, H. R. The Mechanism of Propionic Acid Formation by Succinate Decarboxylation. I. The Activation of Succinate, 772.
——. II. The Formation and Decarboxylation of Succinyl-CoA, 779.
WHITNEY, C. A. See Nail, V. McK., 1168.
WIGNER, E. P. See Inonu, E., 510.
WILLIAMS, R. C. See Fraser, D., 750.
WILSON, E. B. Significance Levels for a Skew Distribution, 537.
——. Vital Statistics of Our Foreign Associates, 1295.
WILSON, P. W. See Repaske, R., 225.
WITKIN, E. M. Effects of Temperature on Spontaneous and Induced Mutations in *Escherichia Coli*, 427.
WOODSON, R. E., JR. Biometric Evidence of Natural Selection in *Asclepias Tuberosa*, 74.
WOOLLEY, D. W. Evidence for the Synthesis of Vitamin B_{12} by Spontaneous Tumors, 6.
WRIGHT, F. B. Absolute Valued Algebras, 330.
WYSS, O. See Fernandez, B., 1052.

X-rays (Baker and Von Halle), 152; chromosome aberrations by (Schneiderman and King), 834; effect on

chromatid aberrations (Swanson and Schwartz), 1241; inactivation of virus by (Bachofer, Ehret, Mayer, and Powers), 744.
X-ray crystallography (Buerger), 678.

Yeast, mitochondria from (Merkel and Nickerson), 1008.
YOST, H. T., JR., SINGLETON, W. R., and BLAKESLEE, A. F. The Effect of Thermal Neutron Radiation on the Chromosomes of *Datura*, 292.
YOST, H. T., JR. See Young, W. J., 488; Ives, P. T., 1134.
YOUNG, W. J., YOST, H. T., JR., IVES, P. T., and LEVINE, R. P. The Effect of Pretreatment with Infra-Red Radiation on the x-Ray Induced Sex-Linked Recessive Lethal and Visible Mutation Rate in *Drosophila Melanogaster*, 488.

ZADEH, L. A. Nonlinear Multipoles, 274.
ZECHMEISTER, L. See Wallcave, L., 604.
ZOCHER, H., and TÖRÖK, C. About Space-Time Asymmetry in the Realm of Classical General and Crystal Physics, 681.
ZUCKER, A. See Reynolds, H. L., 975.